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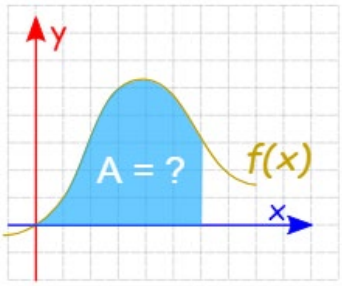
Understanding Integration

Introduction



What is the area under **y = f(x)** ?

What is integration?

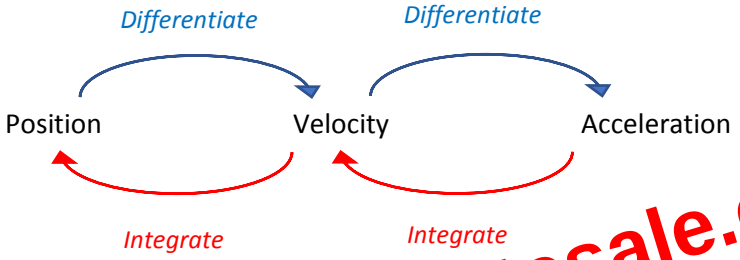
- Reverse differentiation (*anti-differentiation*)

Why use it?

- Used to find **volumes**, **area** and **central points**.
  (1) Calculating areas under graphs (*adding slices to find the whole)*

Application example: equations of motion

- Equations for **position/displacement**, **velocity** and **acceleration** are all related through differentiation and integration:



The basics:

Given a function below:

$$f(x) = 2x^3 + x^2 + 7x$$

If we integrate the function **with respect to x (**written as $\int f(x)dx$**)**, then we write

$\int f(x)dx = f'(x)$ [Apostrophe = ***prime]***

→ $\int (2x^3 + x^2 + 7x)dx$

We focus on the variable x and its **exponents** to **reverse differentiate by one order:**

STEP 1: **Add 1** to each exponent,
STEP 2: **Divide the constant** by the new order.

(1) $\int (2x^{(3+1)} + 1x^{(2+1)} + 7x^{(1+1)})dx$

(2) $\int \left((2 \div 4)x^4 + (1 \div 3)x^3 + (7 \div 2)x^2\right)dx$

$$= \therefore f'(x) = \frac{1}{2}x^4 + \frac{1}{3}x^3 + \frac{7}{2}x^2$$

IMPORTANT NOTE: You can check your answer by **finding its derivative**!